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On the computation of viscoelastic Dean vortices GILMAR MOMPEAN, LAURENT THAIS, LIONEL HELIN, University of Lille — Since the pioneering study by Dean (Proc. Roy. Soc. London, Ser. A, 1928), it is known that the Newtonian flow in a curved channel exhibits transverse recirculations at "Dean" numbers beyond the critical value of 36. More recently, Joo and Shaqfeh (Phys. Fluids A, 1991, 1992) extended Dean's original work for viscoelastic fluids through a linear stability analysis. This work reports on numerical simulations of the three-dimensional viscoelastic flow of Oldroyd-B and Phan-Thien-Tanner fluids in a curved channel. The full three-dimensional momentum equations are solved in general orthogonal coordinates with a staggered finite volume numerical method. The conservative advective terms are discretized with a quadratic upwind scheme (QUICK). The time advancement of the solution follows from an explicit projection method. The Adams-Bashforth level 2 scheme is used to evaluate advection, curvature and viscous terms. The overall formulation is second order accurate in space and time. Results will be presented for various levels of inertia and elasticity, showing that Dean vortices can be induced at lower Dean numbers than observed in the Newtonian case.

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